operations, the making of wood pulp from various kinds of timber, the distillation of turpentine and other products of wood waste, and similar problems are to be included in the forestry work. The United States government will equip the proposed building at a cost of $14,000, and will provide the entire staff of investigators, whose salaries will aggregate $28,000 a year. The laboratory is to be available for advanced university students and instructors in forestry and chemical engineering. The scientific men provided by the forestry service for the laboratory are to give lectures in the university.

The University of Chicago gives the first two years of the medical curriculum of Rush Medical College, which is affiliated with the university. In order to encourage the spirit and method of investigation among students preparing to study medicine, the university offers three scholarships for the session of 1909–10, to be awarded to applicants presenting the best theses embodying the results of independent investigation in any of the sciences fundamental to medicine—physics, chemistry, or any of the biological sciences. The first prize will be a scholarship for three quarters ($180), the second prize a scholarship for two quarters ($120), and the third prize a scholarship for one quarter ($60). This competition is open to members of the graduating class or graduate students of this college. Theses must be sent to the dean of medical courses, The University of Chicago, on or before April 1, 1909.

Arrangements have been made at Lehigh University to keep the conference department open during the Christmas recess. This department, composed of instructors of the university under the direction of one of the professors, is designed to assist students who find difficulty with their current work. It is an innovation in college policy, which is said to have proved a great help since its establishment last September.

By a resolution of the senate of the University of London, it has been decided to ask the government to appoint a royal commission with a view to the introduction of a bill to secure incorporation of the Imperial College of Science and Technology with the University.

We are informed that the note given prominence by the New York papers and reprinted in Science to the effect that Governor Johnson had asked President Roosevelt to accept the presidency of the University of Minnesota is incorrect.

Dr. Adam Sedgwick, professor of zoology at Cambridge, and fellow at Trinity College, has accepted a professorship of zoology at the Imperial College of Science and Technology, London.

At the University of Glasgow, Dr. Cecil H. Desch, of University College, London, has been appointed to the Graham Young lectureship in metallurgical chemistry to succeed Dr. C. E. Fawsitt, who resigned to accept the newly-established chair of chemistry in the University of Sidney, N. S. W.

DISCUSSION AND CORRESPONDENCE

THE "PINCH-EFFECT" IN UNIDIRECTIONAL ELECTRIC SPARKS

Professor Nipher has recently described[1] some interesting experiments on momentum effects in electric discharge, and writes as follows concerning the unidirectional sparks obtained by the insertion into the circuit of strips of cloth moistened with a saline solution:

> . . . the sparks are large and brilliant at the negative end in both positive and negative lines, and thin out towards the positive end. The negative terminals are large spheres of about 10 cm. diameter. The positive terminals are small knobs, of about 1 cm. diameter. *While on the large sphere the electrons repel each other. But when they start into motion across the spark-gap, they attract each other electromagnetically.* This appears to be the reason why the spark thins out as the electrons proceed in their motion across the spark-gap. [The italics are mine.]

According to theory, two like charges repelling each other when at rest, begin to develop an electromagnetic attraction for each other as soon as they are put in motion in the same direction. But this attraction does not be-

[1] Science, December 4, 1908, p. 807.

come equal to the electrostatic repulsion until the charges move with the velocity of light. This used to seem very puzzling to me, for I reasoned as follows: Imagine a positively charged hopper filled with steel balls, which continually dropped into two parallel inclined glass troughs. As the motion of the charged balls is constantly accelerated, the electromagnetic attraction which they exert on the charged balls in the other trough grows larger and larger until the velocity is that of light, when the streams of balls in the two troughs are exerting zero force on each other (for their electrostatic repulsion is then exactly balanced by their electromagnetic attraction), and yet they are said to be behaving like electric currents. Why, then, do parallel currents actually attract each other? No one supposes that a current in a wire travels *faster* than light. Some years ago in Cambridge I asked Professor (now Sir) J. J. Thomson about it, and he replied that my analogy was all right, except that according to the electron theory the glass troughs should have a metal covering outside, which is *positively* charged, the hopper should be *negatively* charged, and the positive charge on a unit's length of a trough should equal the sum of the negative charges on the balls contained in that length. Then the analogy, while crude, would be complete: the steel balls would represent electrons, and the current in the ordinary sense would flow *up* the trough instead of down. The charge on the metal covering of the trough would represent the charges on the positive atoms in a conductor. Under these circumstances it is easy to see that attraction between the troughs would ensue as soon as the balls began to move. Professor Nipher's explanation, therefore, would seem to be valid only on the supposition that the positive ions in the line of the disruptive discharge (which are dashing towards the negative terminal) would take the place of the metal-covered trough in my analogy, thus rendering the electromagnetic attraction of the moving electrons effective in drawing them together in a column which continually thins out towards the positive terminal. If this be true, the effect ought to be rendered more intense because of this consideration: the analogy would then be that of the trough itself (carrying a positive charge) *moving in the opposite direction to the motion of the steel balls,* thus making the relative velocity of the balls greater and the attraction more intense.

But there is another way of looking at it which may be more natural. The negative terminal is a large sphere 10 cm. in diameter, while the positive terminal is but 1 cm. in diameter. The lines of force are therefore strongly convergent from the negative to the positive sphere, somewhat like the ropes from the gas bag of a balloon to the much smaller basket beneath, and electrons sliding down these lines (along their negative direction, of course) would naturally arrange themselves in a column larger at the negative end, especially as these lines are themselves falling towards the center line of the discharge. In this case would not the phenomenon simply show the pinch effect in gaseous discharge?

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MR. MANSON'S THEORY OF GEOLOGICAL CLIMATES

MR. MANSON'S theory of geological climates has been commended latterly in the columns of SCIENCE and elsewhere, and it may be desirable to point out why it is unsatisfactory.

The theory as set forth in Mr. Manson's communication to the Tenth International Geological Congress, in Mexico, in 1906,[1] is briefly as follows: During Paleozoic time the climate of the earth was practically uniform from equator to poles, and torrid temperatures were everywhere maintained by heat derived from the earth and warm oceans; the heat was prevented from radiating into space and being lost by a blanket of clouds surrounding the whole earth. Recognizing that the heat brought to the earth's surface by conduction is not enough to keep up a high atmospheric temperature, Mr. Manson thinks that much heat was made available by the erosion of the land and by hot springs, volcanic eruptions, etc. Let us calculate how much heat can be

[1] *Proceedings,* Vol. I., pp. 349–405.